88. The method according to claim 69 wherein said surface is wood.

89. The method according to claim 72 wherein said surface is selected from the group of metals consisting of aluminum, carbon steel, mild steel, tool steel, stainless steel, hardened steel, and titanium.

Remarks

Claims 1, 29, 36-40, 42, and 43. Claims 2-28, 30-35, and 48 and 52 have been amended. Claims 2-28, 30-35, 41, and 44-89 are pending.

Examination and reconsideration of the application as amended is requested.

Claims 2-28 have been amended to depend directly or indirectly from claim 41. An obvious error as also been corrected in claim 12.

Claims 30-35 have been amended to depend directly or indirectly from claim 44.

Claim 46 has been amended to include the limitations of claim 41.

Claim 52 has been amended to include the limitations of claim 44.

Claim 69 has been amended to include the limitations of claim 53.

Claim 72 has been amended to include the limitations of claim 59.

Support for new claims 81-89 can be found in the specification, for example, on page 32, lines 30-31, bridging sentence, page 33, line 1.

Claims 1 and 29 have been canceled. Cancellation of such claims is not agreement that an amendment or cancellation of such claims is necessary, or that the rejections set forth in the Office Action are proper. Rather, the cancellations, as well as the amendments to claims 46, 52, 69, and 72, are being made to reduce the number of issues and facilitate prosecution. Further, claims 42, and 43 have been canceled as they are now redundant with amended claims 17 and 23.

After further reviewing U.S. Pat. No. 5, 981,415 (Waku et al.) (e.g., at col. 8, lines 10-11 of '415 (Waku et al.), in regard to making material reported therein, that "Alternatively, the melt is once solidified and pulverized and the pulverized material be then set in a crucible and subjected to unidirectional solidification." (underlining added), and the relative amounts of Y_2O_3 used in working examples 5 and 6, which may have provided crystalline complex $Al_2O_3 \cdot Y_2O_3$); and U.S. Pat. No. 4,595,663 (Krohn et al.) (e.g., at col. 4, lines 37-41, which

states "In the manufacture of articles ceramic shapes articles with especially high strengths, a powder of several metal oxides is mixed in a hypoeutectic, eutectic, or hypereutectic ratio, melted and then after rapid cooling, pulverized" (underlining added).

The following arguments with respect to rejections based on U.S. Pat. No. 5,981,415 (Waku et al.) and U.S. Pat. No. 4,595,663 (Krohn et al.) are to replace those provided in the "Amendment Under Rule 111" paper bearing a certificate of mailing date of December 19, 2001, and such earlier arguments are not to be relied upon.

In one aspect, Applicant claims, in claim 41, a plurality of abrasive particles having a specified nominal grade, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of fused, crystalline abrasive particles, the fused abrasive particles comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline ZrO_2 and

(b) at least two of:

(i) crystalline Al_2O_3,

(ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or

(iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$.

In another aspect, Applicant claims, in claim 46, a method for making fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least (a) crystalline ZrO_2 and (b) at least two of (i) crystalline Al_2O_3, (ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or (iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$, the method comprising:

melting at least one Al_2O_3 source, at least one Y_2O_3 source, and at least one ZrO_2 source to provide a melt;

converting the melt to the fused, crystalline abrasive particles; and

grading the fused, crystalline abrasive particles to provide plurality of abrasive particles having a specified nominal grade, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of the fused, crystalline abrasive particles.

In another aspect, Applicant claims, in claim 53, an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of the abrasive particles are fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline ZrO_2 and

(b) at least two of:

(i) crystalline Al_2O_3,

(ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or

(iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$.

In another aspect, Applicant claims, in claim 61, a vitrified bonded abrasive article comprising a plurality of abrasive particles bonded together via vitrified bonding material, wherein at least a portion of the plurality of abrasive particles are fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline ZrO_2 and

(b) at least two of:

(i) crystalline Al_2O_3,

(ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or

(iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$.

In another aspect, Applicant claims, in claim 69, a method of abrading a surface, the method comprising:

providing an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of the abrasive particles are fused, crystalline abrasive particle comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least (a) crystalline ZrO_2 and (b) at least two of (i) crystalline Al_2O_3, (ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or (iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$;

contacting at least one of the fused, crystalline abrasive particles with a surface of a workpiece; and

moving at least one of the contacted fused abrasive particle or the surface relative to the other to abrade at least a portion of the surface with the contacted fused abrasive particle.

In another aspect, Applicant claims, in claim 44, a plurality of abrasive particles having a specified nominal grade, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of fused, crystalline abrasive particles, the fused abrasive particles comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and

(b) crystalline ZrO_2.

In another aspect, Applicant claims, in claim 52, a method for making fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least (a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and (b) crystalline ZrO_2, the method comprising:

melting at least one Al_2O_3 source, at least one Y_2O_3 source, and at least one ZrO_2 source to provide a melt;

converting the melt to the fused, crystalline abrasive particles; and

grading the fused, crystalline abrasive particles to provide plurality of abrasive particles having a specified nominal grade, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of the fused, crystalline abrasive particles.

In another aspect, Applicant claims, in claim 59, an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of the abrasive particles are fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and

(b) crystalline ZrO_2.

In another aspect, Applicant claims, in claim 67, a vitrified bonded abrasive article comprising a plurality of abrasive particles bonded together via vitrified bonding material, wherein at least a portion of the plurality of abrasive particles are fused, crystalline abrasive

particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and

(b) crystalline ZrO_2.

In another aspect, Applicant claims, in claim 72, a method of abrading a surface, the method comprising:

providing an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of the abrasive particles are fused, crystalline abrasive particle comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least (a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and (b) crystalline ZrO_2;

contacting at least one of the fused, crystalline abrasive particles with a surface of a workpiece; and

moving at least one of the contacted fused abrasive particle or the surface relative to the other to abrade at least a portion of the surface with the contacted fused abrasive particle.

Each of Applicants' independent claims 41, 53, 61, and 69 require fused abrasive particle(s) or, in the case of claim 46, result in fused abrasive particles (hereinafter referred to as "*first fused, crystalline abrasive particle(s) of the invention*") comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least: (a) crystalline ZrO_2 and (b) at least two of: (i) crystalline Al_2O_3, (ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or (iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$.

In addition, claim 41 requires, for example, a **plurality of abrasive particles having a specified nominal grade**, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of first fused, crystalline abrasive particles of the invention. Claim 46 is directed to a method of making the plurality of abrasive particles claimed in claim 41. Claims 53 and 61 are directed toward **abrasive articles** comprising first fused, crystalline abrasive particles of the invention. Claim 69 is directed to a method of **abrading a surface with an abrasive**

article comprising first fused, crystalline abrasive particles of the invention, wherein at least one first fused, crystalline abrasive particles of the invention abrades the surface.

Each of Applicants' independent claims 44, 59, 67, and 72 require fused abrasive particle(s) or, in the case of claim 52, result in fused abrasive particles (hereinafter referred to as "*second fused, crystalline abrasive particle(s) of the invention*") comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least: (a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and (b) crystalline ZrO_2.

In addition, claim 44 requires, for example, a **plurality of abrasive particles having a specified nominal grade**, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of second fused, crystalline abrasive particles of the invention. Claim 52 is directed to a method of making the plurality of abrasive particles claimed in claim 44. Claims 59 and 67 are directed toward **abrasive articles** comprising second fused, crystalline abrasive particles of the invention. Claim 72 is directed to a method of **abrading a surface with an abrasive article** comprising second fused, crystalline abrasive particles of the invention, wherein at least one second fused, crystalline abrasive particles of the invention abrades the surface.

U.S. Pat. No. 5,981,415 (Waku et al.)

U.S. Pat. No. 5,981,415 (Waku et al.) reports a ceramic composite material consisting of two or more crystal phases of different components, each crystal phase having non-regular shape, the shape crystal phases having three dimensional continuous structures intertwined with other, at least one crystal phase thereof being a single crystal. The two or more crystal phases of different components constituting the ceramic material may be those of a combination of a eutectic system. It is said the metal oxides include aluminum oxide (Al_2O_3), zirconium oxide (ZrO_2), magnesium oxide (MgO), silicon oxide (SiO_2), titanium oxide (TiO_2), barium oxide (BaO), beryllium oxide (BeO), calcium oxide (CaO), chromium oxide (Cr_2O_3), and rare earth oxides such as La_2O_3, Y_2O_3, CeO_2, Pr_6O_{11}, Nd_2O_3, Sm_2O_3, Gd_2O_3, Eu_2O_3, Tb_4O_7, Dy_2O_3, Ho_2O_3, Er_2O_3, Tm_2O_3, Yb_2O_3, and Lu_2O_3. The complex oxides are said to include $LaAlO_3$, $CeAlO_3$, $PrAlO_3$, $NdAlO_3$, $SmAlO_3$, $EuAlO_3$, $GdAlO_3$, $DyAlO_3$, $ErAlO_3$, Yb_4AlO_9, $Er_3Al_5O_{12}$, $11Al_2O_3 \cdot La_2O_3$, $11Al_2O_3 \cdot Nd_2O_3$, $3Dy_2O_3 \cdot Al_2O_3$,

$2Dy_2O_3 \cdot Al_2O_3$, $11Al_2O_3 \cdot Pr_2O_3$, $EuAl_{11}O_{18}$, $2Gd_2O_3 \cdot Al_2O_3$, $11Al_2O_3 \cdot Sm_2O_3$, $Yb_3Al_5O_3$, $CeAl_{11}O_{18}$, and $Er_2Al_2O_9$.

Notwithstanding the eutectics reported in '415 (Waku et al.), there is no teaching or proper suggestion therein of the at least ternary eutectic as required in Applicant's independent claims 41 and 46, or at least the specific binary eutectic (i.e., eutectic of at least (a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and (b) crystalline ZrO_2) as required in Applicant's independent claims 44 and 52. For example, for Applicant's claims 41 and 46, even if '415 taught or suggested making a material comprising (a) crystalline ZrO_2 and (b) at least two of (i) crystalline Al_2O_3, (ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or (iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$, it is not clear the result would be eutectic of such oxides as required by Applicant. Similarly, for Applicant's claims 44 and 52, even if '415 taught or suggested making a material comprising crystalline complex $Al_2O_3 \cdot Y_2O_3$ and crystalline ZrO_2), it is not clear the result would be eutectic of such oxides as required by Applicant.

Although not necessary to overcome the rejection of '415 (Waku et al.), notwithstanding that it is stated at col. 8, lines 10-11 of '415 (Waku et al.), in regard to making material reported therein, that "Alternatively, the melt is once solidified and pulverized and the pulverized material be then set in a crucible and subjected to unidirectional solidification." (underlining added), and in another aspect, reference is made in the "Background" section of '415 (see col. 2, line 54) to "abrasives" and that it is stated in '415 that "ceramic composite material of the present invention may be useful in many applications in which oxide ceramics such as Al_2O_3 are in practice used", and cutting tool members is listed (see col. 9, line 3) as such an application, '415 does not teach or properly suggest a specified nominal grade of abrasive particles as required in claims 41, 44, 46, and 52. It is submitted that to reach the conclusion that '415 teaches or suggests that the inventions as set forth in claims 41, 44, 46, and 52 requires an impermissible, strained reading of '415 that effectively includes the improper use of hindsight analysis.

U.S. Pat. No. 5,981,415 (Waku et al.) in view of U.S. Pat. No. 4,035,162 (Brothers et al.)

'162 (Brothers et al.) is relied upon to show that fused abrasive grains are known to be used as abrasives in the manufacture of bonded abrasives and coated abrasives.

The independent claims rejected based on '415 (Waku et al.) in view '162 (Brothers et al.) include, for example, the limitations of either claim 41 or 44, plus additional

limitations. Claims 41 and 44 are patentable over '415, for example, for the reasons given above. While not agreeing that there is even proper motivation to combine '415 and '162, even if combined the result is not Applicant's claimed invention as '162 fails to overcome the deficiencies of '415 discussed above.

U.S. Pat. No. 4,595,663 (Krohn et al.)

U.S. Pat. No. 4,595,663 (Krohn et al.) reports ceramic articles containing eutectic constituents consisting of zirconium oxide, hafnium oxide, and mixtures thereof. '663 also reports ceramic articles consisting wholly or predominately of a eutectic constituent of aluminum oxide, zirconium oxide and/or hafnium oxide, which in addition contains yttrium oxide, magnesium oxide, and/or ytterbium oxide. Working Example 1 consists of 57% by weight Al_2O_3, 38% by weight ZrO_2, and 5% by weight Yb_2O_3 (a rare earth oxide). Further, working Example 5 consists of 50% by weight Al_2O_3, 25 % by weight ZrO_2, and 25 % by weight Y_2O_3, working Example 6, 49% by weight Al_2O_3, 28% by weight ZrO_2, and 23% by weight Y_2O_3.

Contrary to the assertion in the Office Action that Applicant is claiming a "material", Applicant submits that the "fused, crystalline abrasive(s)" language in the claims is a claim limitation.

Notwithstanding that it is stated at col. 4, lines 37-41 of '663 (Krohn et al.), in regard to making material reported therein, that "In the manufacture of articles ceramic shapes articles with especially high strengths, a powder of several metal oxides is mixed in a hypoeutectic, eutectic, or hypereutectic ratio, melted and then after rapid cooling, pulverized." (underlining added), '663 does not teach or properly suggest a specified nominal grade of abrasive particles as required in claims 41, 44, 46, and 52.

U.S. Pat. No. 4,595,663 (Krohn et al.) in view of U.S. Pat. No. 5,981,415 (Waku et al.)

As discussed above, neither '663 (Krohn et al.) or '415 (Waku et al.) teach or properly suggest a specified nominal grade of abrasive particles as required in claims 41, 44, 46, and 52. Even assuming arguendo there is proper motivation to combine '663 and '415, there would still remain an absence of a teaching or proper suggestion to lead to the inventions as claimed in claims 41, 44, 46, and 52, as '415 fails to overcome the deficiencies of '663.

U.S. Pat. No. 4,595,663 (Krohn et al.) in view of U.S. Pat. No. 5,981,415 (Waku et al.), and further in view of .U.S. Pat. No. 4,035,162 (Brothers et al.)

'162 (Brothers et al.) is relied upon to show that fused abrasive grains are known to be used as abrasives in the manufacture of bonded abrasives and coated abrasives

Claims 53 and 61 are directed toward **abrasive articles** comprising first fused, crystalline abrasive particles of the invention. Claim 69 is directed toward **abrading a surface with an abrasive article** comprising first fused, crystalline abrasive particles of the invention, wherein at least one first fused, crystalline abrasive particles of the invention abrades the surface.

Claims 59 and 67 are directed toward **abrasive articles** comprising second fused, crystalline abrasive particles of the invention. Claim 72 is directed toward **abrading a surface with an abrasive article** comprising second fused, crystalline abrasive particles of the invention, wherein at least one second fused, crystalline abrasive particles of the invention abrades the surface.

Further, notwithstanding that it is stated in '415 (Waku et al.) at col. 8, lines 10-11, in regard to making material reported therein, that "Alternatively, the melt is once solidified and pulverized and the pulverized material be then set in a crucible and subjected to unidirectional solidification." (underlining added), and in another aspect, reference is made in the "Background" section of '415 (see col. 2, line 54) to "abrasives", and that it is stated in '415 that "ceramic composite material of the present invention may be useful in many applications in which oxide ceramics such as Al_2O_3 are in practice used", and cutting tool members is listed (see col. 9, line 3) as such an application, '415 does not teach or properly suggest using '415 material as abrasive particles in an abrasive article as required in claims 53, 59, 61, 67, 69, and 72. It is submitted that to reach the conclusion that '415 teaches or suggests using '415 material as abrasive particles in an abrasive article as required in claims 53, 59, 61, 67, 69 requires an impermissible, strained reading of '415 that effectively includes the improper use of hindsight analysis. Moreover, as discussed above, even if '415 taught or suggested making a material comprising (a) crystalline ZrO_2 and (b) at least two of (i) crystalline Al_2O_3, (ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or (iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$, it is not clear that the result would be eutectic of such oxides as required by Applicant in claims 53, 61, and 69. Similarly, for Applicant's claims 59, 67, and 72, even if '415 taught or suggested making a material comprising crystalline complex

$Al_2O_3 \cdot Y_2O_3$ and crystalline ZrO_2), it is not clear that the result would be eutectic of such oxides as required by Applicant.

Notwithstanding that it is stated at col. 4, lines 37-41 of '663 (Krohn et al.), in regard to making material reported therein, that "In the manufacture of articles ceramic shapes articles with especially high strengths, a powder of several metal oxides is mixed in a hypoeutectic, eutectic, or hypereutectic ratio, melted and then after rapid cooling, pulverized" (underlining added), '663 does not teach or properly suggest using '663 material as abrasive particles an abrasive article as required in claims 53, 59, 61, 67, 69, and 72.

In view of the '663 (Krohn et al.) and '415 (Waku et al.) disclosures, for example, it is unclear in the absence of the inappropriate use of hindsight analysis, why one of ordinary skill in the art would be motivated to combine '663, '415, and '162 to provide the inventions claimed in claims 53, 59, 61, 67, 69, and 72.

Claims 2-28 and 75-77 add additional limitations to claim 41. Claim 41 is patentable, for example, for the reasons given above. Thus, claims 2-28 and 75-77 should also be patentable.

Claims 30-35 add additional limitations to claim 44. Claim 44 is patentable, for example, for the reasons given above. Thus, claims 30-35 should also be patentable.

Claims 45 and 78-80 add additional limitations to claim 44. Claim 44 is patentable, for example, for the reasons given above. Thus, claims 45 and 78-80 should also be patentable.

Claims 47-51 add additional limitations to claim 46. Claim 46 is patentable, for example, for the reasons given above. Thus, claims 47-51 should also be patentable.

Claims 54-58 add additional limitations to claim 53. Claim 53 is patentable, for example, for the reasons given above. Thus, claims 54-58 should also be patentable.

Claim 60 adds an additional limitation to claim 59. Claim 59 is patentable, for example, for the reasons given above. Thus, claim 60 should also be patentable.

Claims 62-66 add additional limitations to claim 61. Claim 61 is patentable, for example, for the reasons given above. Thus, claims 62-66 should also be patentable.

Claim 68 adds an additional limitation to claim 67. Claim 67 is patentable, for example, for the reasons given above. Thus, claim 68 should also be patentable.

Claims 70, 71, and 81-88 add additional limitations to claim 69. Claim 69 is patentable, for example, for the reasons given above. Thus, claims 70 and 71 should also be patentable.

Claims 73, 74, and 89 add additional limitations to claim 72. Claim 72 is patentable, for example, for the reasons given above. Thus, claims 73 and 74 should also be patentable.

In summary, the rejections of claims 1-4, 9-12, 16-19, 21-25, 27-31, 33-52, and 75-80 over '415 (Waku et al.), claims 53-74 over '415 (Waku et al.) in view of '162 (Brothers et al.), claims 1-12, 16-52, and 75-80 over '663 (Krohn et al.) alone or in view of '415 (Waku et al.), and claims 53-74 over '663 (Krohn et al.) in view of '415 (Waku et al.) and further in view of '162 (Brothers et al.), should be withdrawn.

Terminal Disclaimer

A replacement terminal disclaimer is enclosed to replace the terminal disclaimer bearing a certificate of mailing date of December 19, 2001. Two minor corrections have been made in the insert terminal disclaimer. First, a digit was inadvertently left off the frame number for US Serial Number 09/704,843, this has been corrected. Second, although the Assignment for USSN 09/704,843 was filed with such patent application on November 2, 2000, the recordation date listed on the USPTO Assignment Recordation paper is November 20, 2000, with the November 2, 2000, this has also been corrected.

Further, since December 19, 2001, terminal disclaimers have also been submitted for USSN 09/620,262; 09/618,879; 09/772,730; and 09/704,843. The instant terminal disclaimer has been updated to reflect the submissions of these four additional terminal disclaimers.

It is hereby requested that any fee charged for the submission of the present terminal disclaimer be credited for the filing of the enclosed terminal disclaimer.

It is submitted that the application is in condition for allowance. Reconsideration of the rejection is requested. Allowance of claims 2-28, 30-35, 41, and 44-89, as amended, at an early date is solicited.

Respectfully submitted,

By _____
Gregory D. Allen

Registration Number	Telephone Number
35,048	651-736-0641
Date January 29, 2002	

Office of Intellectual Property Counsel
3M Innovative Properties Company
P.O. Box 33427
St. Paul, Minnesota 55133-3427
Facsimile: (651) 736-3833

p:\allengr\appln\55000\55763\55763-a\55763.002 supl doc

Version With Markings to Show Changes Made

In The Claims

2. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 41 wherein said fused, crystalline abrasive particles comprise [1 comprising] at least 50 percent by volume, based on the total metal oxide volume of the respective [said] particle, of said eutectic material.

3. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 2 comprising, on a theoretical oxide basis, at least 40 percent by weight Al_2O_3, based on the total metal oxide content of the respective [said] particle.

4. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein said fused, crystalline abrasive particles [particle] further comprise [comprises] primary crystals of Al_2O_3.

5. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein said fused, crystalline abrasive particles comprise [particle comprises] colonies of said eutectic, and wherein said colonies have an average size of less than 100 micrometers.

6. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 5, wherein said colonies have an average size of less than 50 micrometers.

7. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein said fused, crystalline abrasive particles comprise [particle comprises] colonies of said eutectic, and wherein crystals making up said colonies are, on average, up to 10 micrometers in size.

8. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 7, wherein said crystals are, on average, up to 1 micrometer in size.

9. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein said fused, crystalline abrasive particles [particle] further comprise [comprises] comprises at least one of crystalline rare earth oxide or crystalline complex Al_2O_3·rare earth oxide.

10. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein said fused, crystalline abrasive particles [particle] further comprise [comprises] at least one of crystalline BaO, CaO, Cr_2O_3, CoO, Fe_2O_3, HfO_2, Li_2O, MgO, MnO, NiO, SiO_2, TiO_2, Na_2O, Sc_2O_3, SrO, V_2O_3, ZnO, or complex Al_2O_3·metal oxide thereof.

11. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein said fused, crystalline abrasive particles have [particle has] an average microhardness of at least 13 GPa.

12. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein said complex Al_2O_3·Y_2O_3 further comprises cations selected from the group consisting of Cr, Ti, Sc, Fe, Mg, Ca, Si, Co, [Co ,] Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sm, Th, Tm, Yb, and combinations thereof.

13. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein a portion of said complex Al_2O_3·Y_2O_3 Al cations are substituted with at least one cation selected from the following cations: Cr, Ti, Sc, Fe, Mg, Ca, Si, and Co.

14. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein a portion of said complex Al_2O_3·Y_2O_3 Y cations are substituted with at least one cation selected from the following cations: Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sm, Th, Tm, and Yb.

15. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 3, wherein a portion of said complex Al_2O_3·Y_2O_3 Y cations are substituted with at least one cation selected from the following cations: Fe, Ti, Mn, V, Cr, Co, Ni, Cu, Mg, Ca, and Sr.

16. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 2, said fused, crystalline abrasive particles [particle] further comprise [comprises] primary crystals of $Y_3Al_5O_{12}$.

17. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 41 [1], wherein said eutectic is eutectic of at least (a) crystalline ZrO_2, (b) crystalline Al_2O_3, and (c) crystalline complex $Al_2O_3 \cdot Y_2O_3$.

18. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 17 comprising at least 50 percent by volume, based on the total metal oxide volume of the respective [said] particle, of said eutectic material.

19. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 18 comprising, on a theoretical oxide basis, at least 40 percent by weight Al_2O_3, based on the total metal oxide content the respective [said] particle.

20. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 19, wherein said fused, crystalline abrasive particles comprise [particle comprises] colonies of said eutectic, and wherein crystals making up said colonies are, on average, up to 10 micrometers in size.

21. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 19, wherein said fused, crystalline abrasive particles [particle] further comprise [comprises] at least one of crystalline BaO, CaO, Cr_2O_3, CoO, Fe_2O_3, HfO_2, Li_2O, MgO, MnO, NiO, SiO_2, TiO_2, Na_2O, SrO, Sc_2O_3, V_2O_3, ZnO, or complex Al_2O_3·metal oxide thereof.

22. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 19, wherein said fused, crystalline abrasive particles have [particle has] an average microhardness of at least 13 GPa.

23. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 2 [1], wherein said eutectic is eutectic of at least (a) crystalline ZrO_2, (b) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, and (c) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$.

24. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 23 comprising at least 50 percent by volume, based on the total metal oxide volume of said particle, of said eutectic material.

25. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 24 comprising, on a theoretical oxide basis, at least 40 percent by weight Al_2O_3, based on the total metal oxide content said particle.

26. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 25, wherein said fused, crystalline abrasive particles comprise [particle comprises] colonies of said eutectic, and wherein crystals making up said colonies are, on average, up to 10 micrometers in size.

27. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 25, wherein said fused, crystalline particles [particle] further comprise [comprises] at least one of crystalline BaO, CaO, Cr_2O_3, CoO, Fe_2O_3, HfO_2, Li_2O, MgO, MnO, NiO, SiO_2, TiO_2, Na_2O, SrO, Sc_2O_3, V_2O_3, ZnO, or complex Al_2O_3·metal oxide thereof.

28. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 25, wherein said fused, crystalline abrasive particles have [particle has] an average microhardness of at least 13 GPa.

Please amend claims 30-35 as follows:

30. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 44 [29] comprising at least 50 percent by volume, based on the total metal oxide volume of the respective [said] particle, of said eutectic material.

31. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 30 comprising, on a theoretical oxide basis, at least 40 percent by weight Al_2O_3, based on the total metal oxide content the respective [said] particle.

32. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 30, wherein said fused, crystalline abrasive particles comprise [particle comprises] colonies of said eutectic, and wherein crystals making up said colonies are, on average, up to 10 micrometers in size.

33. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 30, wherein said fused, crystalline abrasive particles [particle] further comprise [comprises] comprises at least one of crystalline BaO, CaO, Cr_2O_3, CoO, Fe_2O_3, HfO_2, Li_2O, MgO, MnO, NiO, SiO_2, TiO_2, Na_2O, SrO, Sc_2O_3, V_2O_3, ZnO, or complex Al_2O_3·metal oxide thereof.

34. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 30, wherein said fused, crystalline abrasive particles have [particle has] an average microhardness of at least 13 GPa.

35. The plurality of [fused, crystalline] abrasive particles [particle] according to claim 30 wherein at least a majority by weight of said crystalline ZrO_2 is cubic ZrO_2.

Please amend claims 46, 52, 69, and 72 as follows;

46. A method for making fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein said eutectic material comprises eutectic of at least (a) crystalline ZrO_2 and (b) at least two of (i) crystalline Al_2O_3, (ii) first crystalline complex Al_2O_3·Y_2O_3, or (iii) second, different, crystalline complex Al_2O_3·Y_2O_3, said method comprising:

melting at least one Al_2O_3 source, at least one Y_2O_3 source, and at least one ZrO_2 source to provide a melt; [and]

converting the melt to said fused, crystalline abrasive particles; and

grading said fused, crystalline abrasive particles to provide a plurality of abrasive particles having a specified nominal grade, said plurality of abrasive particles having a

particle size distribution ranging from fine to coarse, wherein at least a portion of said plurality of abrasive particles is a plurality of said fused, crystalline abrasive particles.

52. A method for making fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein said eutectic material comprises eutectic of at least (a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and (b) crystalline ZrO_2, said method comprising:

melting at least one Al_2O_3 source, at least one Y_2O_3 source, and at least one ZrO_2 source to provide a melt; [and]

converting the melt to said fused, crystalline abrasive particles; and

grading said fused, crystalline abrasive particles to provide a plurality of abrasive particles having a specified nominal grade, said plurality of abrasive particles having a particle size distribution ranging from fine to coarse, wherein at least a portion of said plurality of abrasive particles is a plurality of said fused, crystalline abrasive particles.

69. A method of abrading a surface, said method comprising:

providing an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of said abrasive particles are [contacting at least one] fused, crystalline abrasive particle comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein said eutectic material comprises eutectic of at least (a) crystalline ZrO_2 and (b) at least two of (i) crystalline Al_2O_3, (ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or (iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$; [,]

contacting at least one of said fused, crystalline abrasive particles with a surface of a workpiece; and

moving at least one of the contacted [said] fused abrasive particle or said surface relative to the other to abrade at least a portion of said surface with the contacted [said] fused abrasive particle.

72. A method of abrading a surface, said method comprising:

providing an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of said abrasive particles are [contacting at least one] fused, crystalline abrasive particle comprising at least 20 percent by volume, based on the total

volume of the respective particle, eutectic material, wherein said eutectic material comprises eutectic of at least (a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and (b) crystalline ZrO_2; [.]

contacting at least one of said fused, crystalline abrasive particles with a surface of a workpiece; and

moving at least one of the contacted [said] fused abrasive particle or said surface relative to the other to abrade at least a portion of said surface with the contacted [said] fused abrasive particle.